

# Attempting to Cross the Chasm - the Experience of a Pollution Prevention Technology

Gary Cohen, RadTech

# What is RadTech?

- Non Profit Trade Association for UV/EB
- Based in Bethesda, MD
- About 20 Years of Service
- Over 700 Members
- Support Over 20 Manufacturing Industries
- [www.radtech.org](http://www.radtech.org)



# Michigan Organizations Showing Interest in UV/EB

A&K Finishing, Inc.

Aal Chem

AkzoNobel Coatings Inc

Allied PhotoChemical

Anderson Development Ci

Applied Molecules

AQUVSOL

BASF Corporation

Continental Corp

Dart Container Corp

Dedoes Industries, Inc.

Dow Chemical

Eastern Michigan University

Electronics For Imaging, Inc.

Ford Motor Company

Evonik Goldschmidt Corporation

Flint Group NA

Freudenberg-NOK General  
Partnership

Gentex Corporation

GOI MOD/US Tacom

Guardina Ind Corp

Harman

Haworth

Henkel Corporation

Herman Miller

Hilco Technologies

Intertape Polymer Group

ITW Security and Brand Identity

Jetrion

Kay Automotive Graphics

Kellogg Company

L&L Products, Inc.

Lakeland Finishing Corp.

Lorin Industries

Masco Corp

Michigan State University

Middletons Mouldings

Momentive Performance Materials

MSU

NCMS

ND Industries

Nichia Corporation

Northern Coatings and Chemical  
Co.

Omni Tech International, Ltd.

Panel Processing Inc

PhibroChem

Precision Coatings, Inc.

Prime UV

Prizmatix

Rad-Solutions

Red Spot Paint & Varnish Co, Inc.

Resinate Materials Group

Saint Clair Systems

Shadvin Industries

Stiles Machinery

Sun Chemical Corp

The Dow Chemical Company

Thierica Equipment

Toyota Motor Engineering and  
Manufacturing NA

Transtar Autobody Technologies,  
Inc.

University of Michigan

VacuCoat

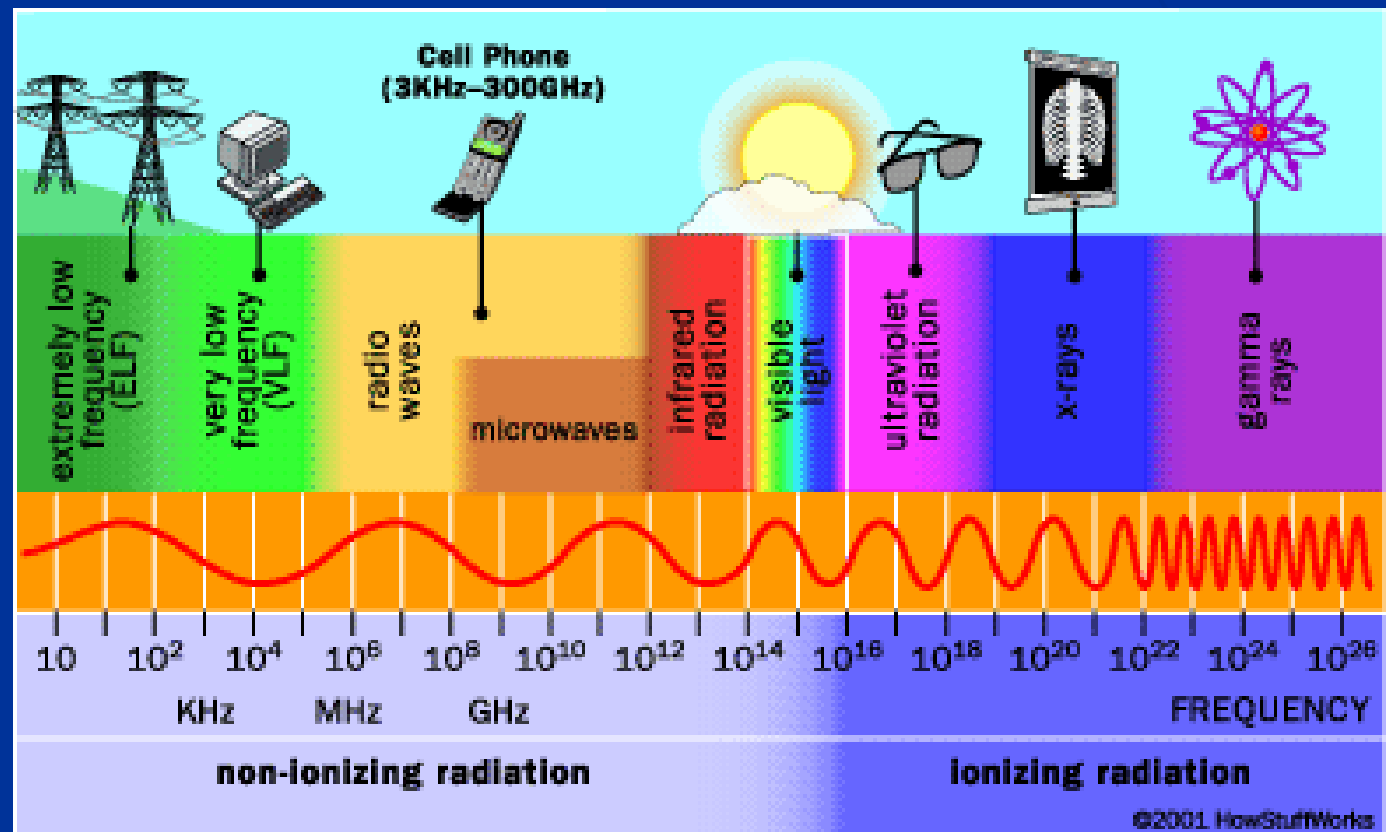
Van Horn, Metz, Inc.

Western Michigan University

Whitlam Label Co. Inc.



# [Rad]iation [Tech]nologies



# [Rad]iation [Tech]nologies

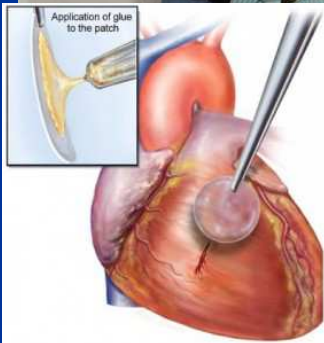
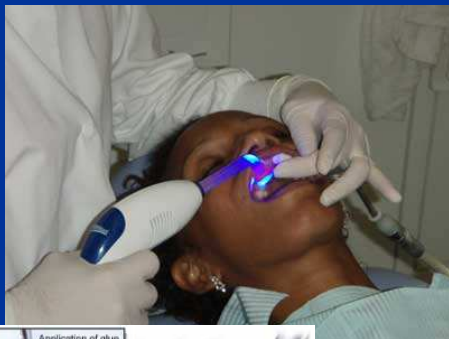
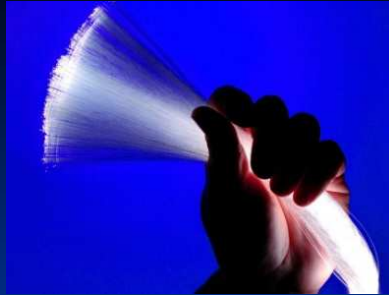
**UV = Ultraviolet Light**



**EB = Electron Beam**

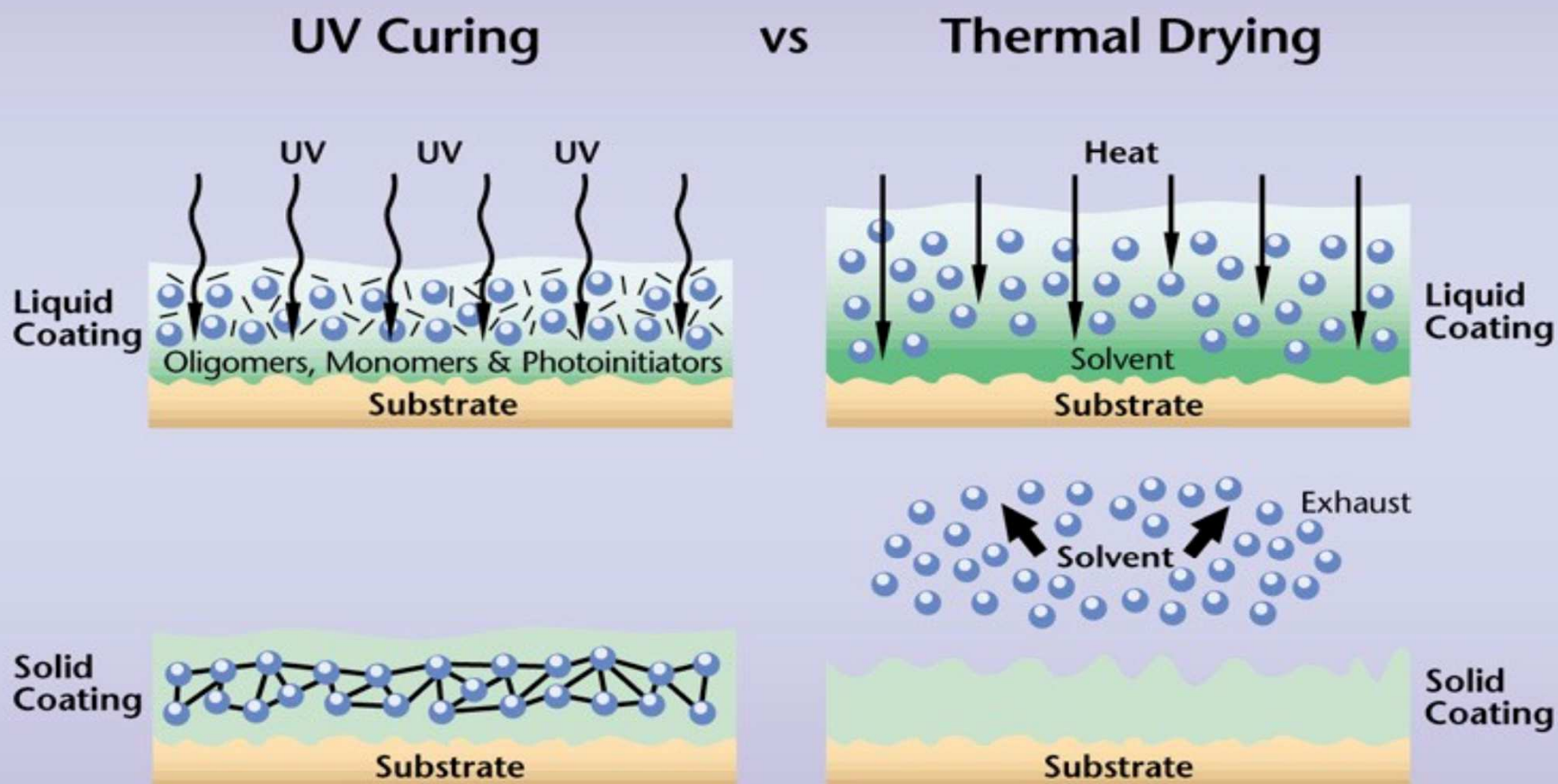






# Chemistry & Formulation of UV/EB

What are the differences between Conventional and UV/EB?





# UV/EB Curing

- A True "Pollution Prevention" Technology
  - No/low VOCs, HAPs, CO<sub>2</sub>
- Not an end-of-pipe control technology
- Energy is not used to process and/or transport and/or eliminate and/or destroy harmful emissions

# The Story of Stuff\*

(UV/EB generally does not need)

1. Make/Process **Stuff**

2. Transport **Stuff**

Make Product with Stuff

3. Drive **Stuff** off the Product

4. Figure out what to do with **Stuff**

\*Stuff—generally solvent and/or water

# UV/EB $\Rightarrow$ Reduced Transport Carbon Emissions

- **Truck Fuel Mileage:** 5.7 mpg
- **CO<sub>2</sub> Emissions /gallon:** 22.4 Pounds
- **Average length of haul:** 500 miles
- **Fuel gallons/haul:** 89.9
- **Emissions per haul:** 2,014 lb CO<sub>2</sub>

Source: Armstrong World Industries Inc.; References for estimates and conversion factors : US EIA



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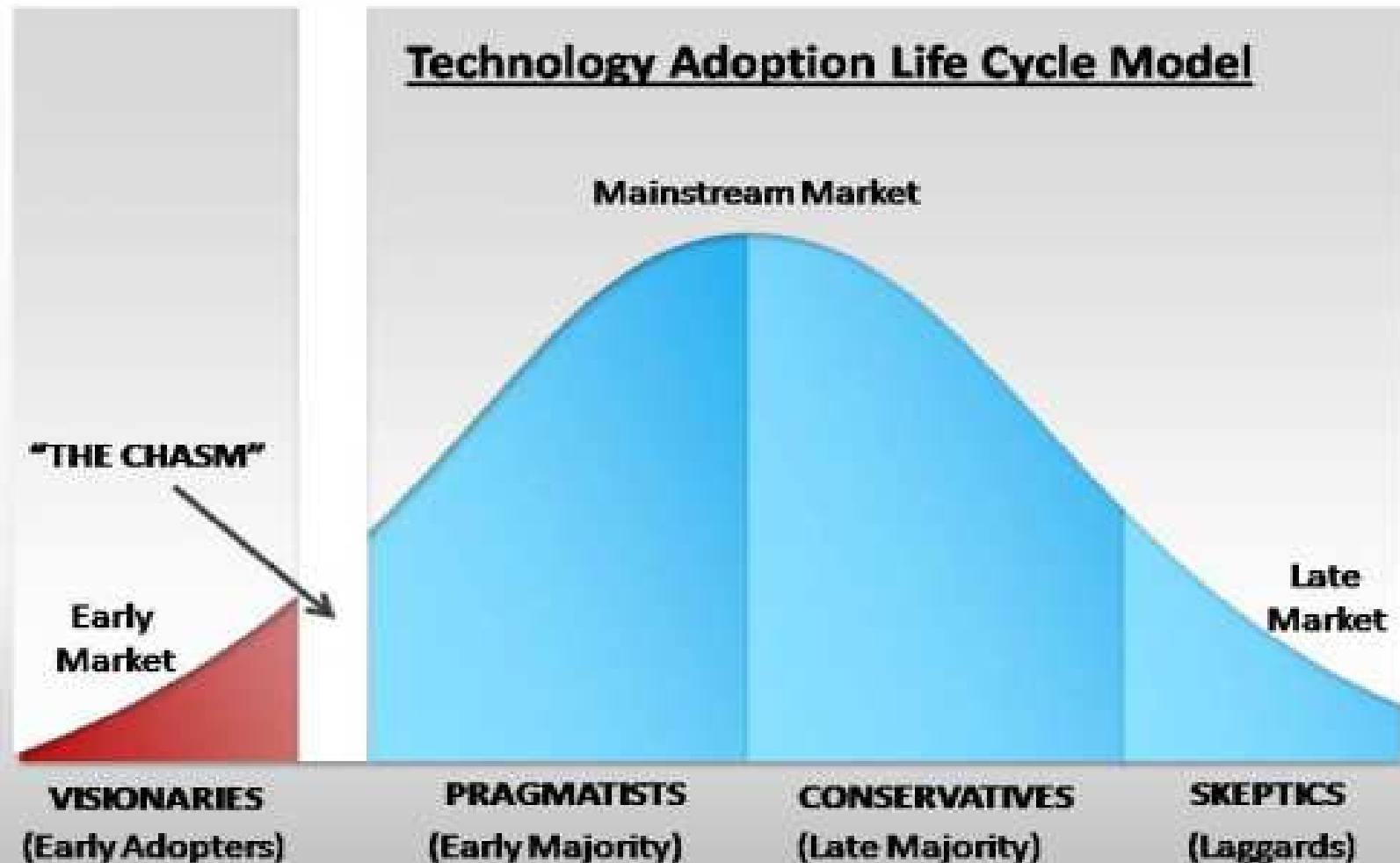


# NYSERDA UV/EB Funding Opportunity

“... to develop innovative applications of UV and EB technology as an example of how NYSERDA research and development efforts are working to create new economic activity based on innovative, **green and sustainable technologies that use energy efficiently and reduce greenhouse gases** in New York's economy.”

Francis J. Murray, Jr.,  
NYSERDA President and CEO

# Crossing The Chasm



Your Logo

\* Moore, Geoffrey. Crossing the Chasm, Marketing and Selling High Tech Products to Mainstream Customers. New York: Harper Business Essentials, 1991.

# Challenges to Crossing the Chasm

- ☐- Risk/uncertainty
- ☐- Disruption of current process
- ☐- Lack of data
- ☐- Need to deal with multiple vendors
- ☐- Need consensus with multiple managers
- ☐- Expense

# Challenges to Crossing the Chasm

- Diverse supplier base
- Lack of industry standards
- Secrecy
- Supplier reticence
- End User reticence
- General lack of regulatory vision
- Bad experience when tech first developed
- Disappearing customer base ??



# Success to Crossing the Chasm

- ❑ Innovation matures
- ❑ Data is available on competitors success
- ❑ Urgent motivation
  - Strategy: Target beachhead (customer under market pressure)
  - Leverage success to other applications

# Coors Brewing Company

## Total Energy Usage

(Million BTU/Billion Cans)

|             | <u>W/B Thermal<br/>Uncontrolled</u> | <u>W/B Thermal<br/>+Incineration</u> | <u>UV Curing</u> |
|-------------|-------------------------------------|--------------------------------------|------------------|
| Electrical  | 16,300                              | 19,500                               | 15,900           |
| Natural Gas | 23,900                              | 60,100                               | 0                |
| Total       | 40,200                              | 79,600                               | 15,900           |

# Coors Brewing Company

Total Air Emissions (Metric Tons/Billion Cans)

|                 | <u>W/B Thermal<br/>Uncontrolled</u> | <u>W/B Thermal<br/>+Incineration</u> | <u>UV Curing</u> |
|-----------------|-------------------------------------|--------------------------------------|------------------|
| CO <sub>2</sub> | 2,909                               | 5,182                                | 1,727            |
| Nitrogen Oxides | 8.1                                 | 11.6                                 | 6.5              |
| VOC             | 28                                  | 0.56                                 | 0.52             |
| HAP             | 11.5                                | 0.23                                 | 0.12             |
| Non-Methane HC  | 0.05                                | 0.10                                 | 0.02             |
| CO              | 0.52                                | 1.11                                 | 0.15             |

# BASF UV-Cured Web Coated Pressure Sensitive Adhesive

## Energy Demand

|                                                    | <u>UV</u><br><u>acResin</u> | <u>Solvent</u> | <u>Waterborne</u><br><u>Dispersion</u> |
|----------------------------------------------------|-----------------------------|----------------|----------------------------------------|
| Electricity Consumption<br>(MWh/yr)                | 3,917                       | 2,758          | 5,376                                  |
| Nat Gas-Curing (kft <sup>3</sup> /yr)              | 0                           | 147,494        | 115,200                                |
| Nat Gas-VOC Incineration<br>(kft <sup>3</sup> /yr) | 0                           | 64,128         | 0                                      |
| Total Energy Demand<br>(Million Btu/yr)            | 39,178                      | 179,662        | 172,549                                |



# Compared with Traditional Technology

|                                      |        | Solvent Process            |                  | EB Process                |                 |
|--------------------------------------|--------|----------------------------|------------------|---------------------------|-----------------|
|                                      | Units  | Input                      | Results          | Input                     | Results         |
| Line Speed                           | FPM    | 1000                       |                  | 1000                      |                 |
| Length of Dryer                      | Feet   | 22.7                       |                  | 6                         |                 |
| Printing width                       | Inches | 54                         |                  | 54                        |                 |
| Working Hours per Year               | Hours  | 4680                       |                  | 4680                      |                 |
| <b>Gas Consumption</b>               | BTU/Hr | 9,460,000                  |                  | 0                         |                 |
| Gas therm/hr (1 therm = 100,000 btu) |        | 95                         |                  | 0                         |                 |
| Cost per therm                       |        | \$1.66                     |                  | \$0.00                    |                 |
| running-Cost per hour (Gas)          |        | \$1.66 x 95                | \$157.70         | 0                         | \$0.00          |
| <b>Electrical Consumption</b>        | KW/Hr  | 22.8                       |                  | 59                        |                 |
| Cost per KWH                         |        | \$0.07                     |                  | \$0.07                    |                 |
| Running-Cost per hour (Electric)     |        | \$0.065 x 22.8             | \$1.48           | \$0.065 x 22.8            | \$3.84          |
| <b>Nitrogen Consumption</b>          | Scfh   | 0                          |                  | 5940                      |                 |
| Cost per 100 scf Nitrogen            |        | 0                          |                  | \$0.28                    |                 |
| Running-Cost per hour (Nitrogen)     |        |                            | \$0.00           | \$0.28 x 59.4             | \$16.63         |
| <b>Combined Utility Expenses</b>     |        |                            |                  |                           |                 |
| Running-Cost per hour                |        |                            | \$159.18         |                           | \$20.47         |
| <b>Annualized Utility Expenses</b>   |        |                            |                  |                           |                 |
| <b>Running-Cost per year</b>         |        | <b>\$159.18 x<br/>4680</b> | <b>\$744,962</b> | <b>\$20.47 x<br/>4680</b> | <b>\$95,800</b> |

# Safety and Handling

## COMPARING SOLVENT & UV/EB SYSTEMS

|                   | <u>SOLVENTS</u> | <u>UV/EB</u> |
|-------------------|-----------------|--------------|
| ■ Explosive vapor | mostly yes      | no           |
| ■ VOC             | yes             | no/low       |
| ■ HAPs            | yes/no          | no           |
| ■ Energy Use      | high            | low          |

**Thank you!**

**[www.radtech.org](http://www.radtech.org)**